METABOLIC SYNDROME RISK DIFFERENTIATED BY SEX IN KOREAN ADULTS

Won O. Song (Presenter)$^1$, SuJin Song$^1$, YoonJu Song$^2$, Hee Young Paik$^3$

$^1$Michigan State University
$^2$The Catholic University of Korea
$^3$Seoul National University

Gender Summit 6 Asia Pacific 2015
PARALLEL SESSION 2: Workshop on Gendered Innovations in Research
27 Aug 2015, Seoul, Korea
Metabolic syndrome (MetS)

“a group of signs and symptoms that occur together and characterize a particular abnormality or condition” [Syndrome]

“Insulin Resistance Syndrome”, “Syndrome X”

“a condition that impairs normal functioning typically manifested by distinguished signs and symptoms” [Disease]
Causes of death

- In 2012, 17.5 million deaths caused by CVD and 1.5 million deaths caused by diabetes
- 1/3 of all female deaths due to CVD and stroke

Source: WHO website
Prevalence of MetS

Prevalence of the Metabolic Syndrome According to the ATPIII Definition
Bars illustrate Prevalence %

- France: Men 10, Women 7
- Finland: Men 14, Women 17
- Australia: Men 20, Women 22
- Ireland: Men 22, Women 22
- U.S.: Men 27, Women 21
- Mexico: Men 27, Women 27
- Turkey: Men 39, Women 27
- Iran: Men 42, Women 24
- India*: Men 47, Women 36
- U.S. (Native Americans): Men 44, Women 57

Prevalence of MetS in Korean adults

MS = 24.9% (1998)

MS = 31.3% (2007)

Lim S et al. Diabetes Care 2011;34(6):1323-1328
## Diagnostic Criteria: NCEP ATPIII

Individuals must have 3 or more of the following:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated waist circumference (WC)</td>
<td>$&gt; 102$ cm in men, $&gt; 88$ cm in women</td>
</tr>
<tr>
<td></td>
<td>$\geq 90$ cm in men, $\geq 80$ cm in women (Asian; IDF)</td>
</tr>
<tr>
<td>Elevated triglycerides (TG)</td>
<td>$\geq 150$ mg/dL</td>
</tr>
<tr>
<td>Low HDL-cholesterol (HDLC)</td>
<td>$&lt; 40$ mg/dL in men, $&lt; 50$ mg/dL in women</td>
</tr>
<tr>
<td>Elevated blood pressure (BP)</td>
<td>$\geq 130/85$ mmHg; $\geq 140/90$ mmHg (WHO)</td>
</tr>
<tr>
<td>Elevated fasting blood glucose (FBG)</td>
<td>$\geq 100$ mg/dL</td>
</tr>
</tbody>
</table>

Grundy SM et al. Circulation 2005;112:2735-2752
Study Questions

The risk of MetS differentiated by sex in Korean adults?

HOW?

WHY?
Data & Subjects

• The nationally representative sample data from the Korea National Health and Nutrition Examination Survey for 2008–2012

• A total of 20,826 adults (8,842 men and 11,984 women) aged 19+ years with no diagnosed diabetes, hypertension, or dyslipidemia

Diagnosis of MetS

• By the criteria of the National Cholesterol Education Program Adult Treatment Panel III

• The presence of ≥ 3 of the components
Age-standardized prevalence of MetS by sex

The chi-square was used to test differences in prevalence of MetS by sex (***p<0.001).
The chi-square was used to test differences in prevalence of MetS components by sex (**p<0.001).
**Combinations of MetS components among subjects with MetS by sex**

<table>
<thead>
<tr>
<th>Combinations of MetS components</th>
<th>Men (n=1772)</th>
<th>Women (n=1943)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated WC Elevated TG Low HDLC Elevated FBG Elevated BP</td>
<td>% (SE)</td>
<td>% (SE)</td>
</tr>
<tr>
<td>X X x x</td>
<td>13.2 (1.0)</td>
<td>23.5 (1.2)</td>
</tr>
<tr>
<td>X x x x</td>
<td>5.0 (0.6)</td>
<td>2.3 (0.4)</td>
</tr>
<tr>
<td>X x x x</td>
<td>8.4 (0.8)</td>
<td>2.4 (0.5)</td>
</tr>
<tr>
<td>X x x x</td>
<td>3.0 (0.4)</td>
<td>12.0 (0.9)</td>
</tr>
<tr>
<td>X x x x</td>
<td>2.7 (0.5)</td>
<td>10.5 (0.8)</td>
</tr>
<tr>
<td>X x x x</td>
<td>4.9 (0.6)</td>
<td>4.8 (0.6)</td>
</tr>
<tr>
<td>X x x x</td>
<td>8.3 (0.8)</td>
<td>3.8 (0.5)</td>
</tr>
<tr>
<td>X x x x</td>
<td>9.9 (0.9)</td>
<td>4.1 (0.5)</td>
</tr>
<tr>
<td>X x x x</td>
<td>8.8 (0.9)</td>
<td>0.9 (0.2)</td>
</tr>
<tr>
<td>X x x x</td>
<td>2.0 (0.4)</td>
<td>2.5 (0.4)</td>
</tr>
<tr>
<td>X x x x</td>
<td>6.3 (0.7)</td>
<td>9.1 (0.8)</td>
</tr>
<tr>
<td>X x x x</td>
<td>7.0 (0.7)</td>
<td>8.8 (0.8)</td>
</tr>
<tr>
<td>X x x x</td>
<td>6.3 (0.7)</td>
<td>2.0 (0.4)</td>
</tr>
<tr>
<td>X x x x</td>
<td>2.0 (0.4)</td>
<td>5.4 (0.6)</td>
</tr>
<tr>
<td>X x x x</td>
<td>6.3 (0.7)</td>
<td>1.6 (0.3)</td>
</tr>
<tr>
<td>X x x x</td>
<td>6.0 (0.7)</td>
<td>6.3 (0.7)</td>
</tr>
</tbody>
</table>

- **WC**: Waist Circumference
- **TG**: Triglycerides
- **HDLC**: High-Density Lipoprotein Cholesterol
- **FBG**: Fasting Blood Glucose
- **BP**: Blood Pressure

**No. of MetS components**

*3 and 4 combinations are highlighted to indicate an increase in the percentage of women compared to men.*
Age-specific prevalence of MetS and its components by sex (1)

The chi-square was used to test differences in prevalence of metabolic syndrome and its components between men and women by age groups (*p<0.05, **p<0.01, ***p<0.001).
Age-specific prevalence of MetS and its components by sex (2)

The chi-square was used to test differences in prevalence of metabolic syndrome and its components between men and women by age groups (*p<0.05, **p<0.01, ***p<0.001).
Age-specific prevalence of MetS and its components by sex (3)

The chi-square was used to test differences in prevalence of metabolic syndrome and its components between men and women by age groups (*p<0.05, **p<0.01, ***p<0.001).
Dyslipidemia
Hypertension

Diabetes
Abdominal Obesity

Insulin resistance
Inflammation
Prothrombotic state
Endothelial dysfunction
Cardiovascular disease

Polycystic ovary disease
Sleep apnea
Non-alcoholic fatty liver disease
Cancer
Hyperuricemia & gout

Genetics, Aging
Obesity and inactivity
Medications
PCOS
Atherosclerosis
Dyslipidemia
Hypertension
IUGR
Risk factors of MetS

• Gender related behaviors

Carbohydrate Intake and Refined-Grain Consumption Are Associated with Metabolic Syndrome in the Korean Adult Population

Dietary patterns based on carbohydrate nutrition are associated with the risk for diabetes and dyslipidemia

High intake of whole grains and beans pattern is inversely associated with insulin resistance in healthy Korean adult population

SuJin Song a, Hee-Young Paik a, YoonJu Song b,*

a Department of Food and Nutrition, Seoul National University, Seoul 151-742, Republic of Korea
b Department of Food and Nutrition, The Catholic University of Korea, Gyeonggi-do 420-743, Republic of Korea

Source: WHO website
Basis of diagnostic criteria

**Low HDLC**
- **Men < 40 mg/dL, Women < 50 mg/dL**
- Associated with insulin resistance or hyperinsulinemia
- Based on insulin resistant men in US and hypertensive men and women in Sweden and Finland
- **Men < 43 mg/dL, Women < 48 mg/dL for Korean adults (Moon et al. 2015)**

**Elevated WC**
- **Men > 102 cm, Women > 88 cm (in Caucasians)**
- **Men ≥ 90 cm, Women ≥ 80 cm (in Asian; IDF)**
- Associated with cardiovascular risk factors
- Based on South Asian population
- **Men ≥ 90 cm, Women ≥ 85 cm for Korean adults (Lee et al. 2007)**
Different effect of MetS on chronic diseases

- In several studies of meta-analysis, MetS was a stronger predictor for CVD morbidity and mortality in women

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Design</th>
<th>Outcome Description</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hu G et al. (2004)</td>
<td>Cohort studies</td>
<td>CVD death</td>
<td>2.26 (1.61–3.17)</td>
<td>1.57 (1.41–1.75)</td>
<td>2.78 (1.57–4.94)</td>
</tr>
<tr>
<td>Galassi A et al. (2006)</td>
<td>Cohort studies</td>
<td>CVD events</td>
<td>1.61 (1.42–1.83)</td>
<td>1.57 (1.41–1.75)</td>
<td>2.10 (1.79–2.45)</td>
</tr>
<tr>
<td>Gami AS et al. (2007)</td>
<td>Cohort studies</td>
<td>CVD events &amp; death</td>
<td>1.78 (1.58–2.00)</td>
<td>1.98</td>
<td>2.63</td>
</tr>
<tr>
<td>Hui WS et al. (2010)</td>
<td>Cohort studies</td>
<td>All cause death</td>
<td>1.46 (1.35–1.57)</td>
<td>1.44 (1.32–1.58)</td>
<td>1.51 (1.37–1.66)</td>
</tr>
</tbody>
</table>
Conclusions & Implications

The risk of MetS differentiated by sex in Korean adults

**HOW**

- Reestablish the sex-specific diagnostic criteria of MetS
- Investigate MetS pathogenesis based on sex and gender related risk factors
- Develop preventive and therapeutic strategies of MetS according to specific sex and age group, especially focusing on middle-aged and elderly women
- Identify different effect of MetS on further progression to chronic diseases by sex

**WHY**
Thank you

Gender Summit 6 Asia Pacific 2015